

Maternal insulin competence and sexual dimorphism in human fat patterning. B.L. O'NEIL, University of Pennsylvania, Philadelphia, PA 19104.

Resembling the primitive primate condition, human males preferentially deposit fat in the abdominal area, while females tend to store fat peripherally, i.e., in the hips and thighs. Prior explanations of the origins of sexual dimorphism in fat patterning have invoked sexual selection for generalized female reproductive fitness, emphasizing its display value. Such theories fail to suggest specific biological reasons for the quantitative reorganization of physiologically dynamic tissues with complex, site-specific functions, as represents the female specialization.

Synthesis of research from a number of populations shows that male-like abdominal fat is associated with greater morbidity and mortality from a host of cardiovascular and metabolic diseases, in particular adult-onset diabetes due to its volatility and anti-insulin effects. While such chronic diseases are not expected to have been prevalent in prehistory, one ever-present selective agent -the insulin resistance of normal pregnancy (gestational diabetes mellitus -GDM- in frank form)- would have exerted considerable pressure to relocate fat from the abdominal area to the relatively quiescent hip/thigh depots.

I propose here that the dual insulin challenge of placental hormones and abdominal fat is probabilistically incompatible with successful pregnancy outcomes, an hypothesis supported by recent research linking abdominal fat with gestational glucose intolerance. Pregnancy-related insulin resistance causes complications which can result in fetal or maternal death. Evolutionarily, female-type fat patterning adds to the suite of traits that result in effective insulin production and usage, termed here, "maternal insulin competence." This perspective can inform research into the complex epidemiology of GDM, and contribute to the New Physical Anthropology of women's bodies.

Ancient DNA Patterns and the Peopling of the Americas. D.H. O'ROURKE, S.W. CARLYLE and M.G. HAYES. Laboratory of Biological Anthropology, University of Utah, Salt Lake City, UT 84112

Geographic patterns of genetic variation in native America have been used in many analyses to address the nature and timing of entry of the original colonists to the Americas. Recently, ancient (a)DNA from archaeologically derived samples have been studied to identify similar patterns in prehistoric populations, and to confirm or reject colonization scenarios based on the distribution of genetic variation in contemporary populations.

The majority of aDNA studies have focused on a small number of discrete markers that define Amerindian mitochondrial (mt)DNA haplogroups. More recent aDNA studies have also examined sequence variation in the mitochondrial hypervariable region. This paper reports

original aDNA research from the US Southwest, Eastern Great Basin, and North American arctic, along with published comparative data from the US west and midwest, as well as Central and South America which indicate that 1) all mtDNA lineages characterizing modern Amerinds were present in antiquity, 2) some haplogroups that are rare, or absent, in contemporary Amerind populations may have been present, and possibly frequent, prehistorically, and c) distinctive regional patterns of variation evident in modern groups were well established several thousands of years ago. These results suggest that 1) the earliest colonists were characterized by considerable mitochondrial genetic variation, weakening claims for a reduction in Amerind genetic variation as a result of a bottleneck or small, discrete migrations to North America, 2) population substructure in native America is of considerable antiquity, and 3) it was little influenced by population declines at contact or subsequent non-Amerind admixture.

While aDNA studies contribute substantively to the debate surrounding Amerindian origins, they are hampered by continued reliance on mtDNA variability, lack of access to samples in the critical 10,000-25,000BP time range, and absence of comparative data from prehistoric samples from NE Asia. Future aDNA research into Amerindian origins will likely focus on rectifying these deficiencies.

This work was supported by grants from the National Science Foundation, Wenner-Gren Foundation for Anthropological Research, and the University of Utah.

A comparison of the anthropometric indices of nutritional status in Tukanoan and Achuar Amerindians. C.M. ORR, D.L. DUFOUR and J.Q. PATTON, Department of Anthropology, University of Colorado at Boulder, CO 80309-0233.

Anthropometric data from a Tukanoan population from the Vaupes region of Colombia and an Achuar population from the Ecuadorian Amazon were compared. The Tukanoans exploit an oligotrophic blackwater ecosystem. The Achuar inhabit a resource rich upland/montane ecosystem. Given this ecological distinction, we proposed three hypotheses regarding nutritional statuses: 1) The Vaupes population is significantly shorter than the Achuar, indicating a greater degree of stunting; 2) The Vaupes population is significantly leaner, indicating a greater degree of wasting; 3) The Vaupes population has significantly less upper arm muscle area, indicating lower lean body mass.

Z-scores were determined by reference to international standards and significant nutritional stress assumed at  $z \leq -2.0$ . Interpopulation z-score differences for ht-for-age (ZHT), wt-for-ht (ZWH) and upper arm muscle area (ZUMA) were examined using analysis of variance. Significant differences were followed up with Scheffe's multiple comparison test. Trends in z-scores versus age were examined using analysis of covariance.

Both populations showed stunting in most age-groups, but neither showed low ZWH or ZUMA. Significant interpopulation differences existed only for ZHT in children (females 1.0-4.9 and 5.0-9.9 yrs, and males 5.0-9.9 yrs). No interpopulation differences were found for ZWH and ZUMA. Significant interpopulation differences in regression line slopes for age versus ZHT were found for both sexes, but not for ZWH or ZUMA.

These differences may be accounted for in part by ecological differences, or possibly the result of secular changes or inaccurate age-data.

Analysis supported by a grant from the University of Colorado Undergraduate Research Opportunities Program.

**Scurvy: its skeletal manifestations and prevalence in North and South American skeletal samples.** D. J. ORTNER Smithsonian Institution, Washington, D.C. 20560.

At the time of initial European contact some Native American tribes were able to both diagnose scurvy and treat it (Vogel 1970). This indicates that dietary problems were present in Native American communities and that the potential exists for scurvy to be identified and studied in human remains from archeological skeletal samples. Despite this potential there are very few reports of scurvy in Native American skeletal remains.

Research reported by Ortner and Erickson (1997) on the manifestations of scurvy in subadult skulls provided the basis for an extensive survey for evidence of this disease in subadult human remains in the collection of the National Museum of Natural History, Smithsonian Institution. The critical and virtually pathognomonic feature is a bilateral porosity primarily of the greater wing of the sphenoid. The results of this survey in North American materials ( $N = 646$ ) indicate a range of prevalence in skeletal manifestations of scurvy from absent (in a sample from South Dakota) to 14 percent (in a sample from Florida). In South American samples ( $N = 386$ ) the prevalence was about 10 percent.

These data indicate that scurvy was a significant source of morbidity in some Native American tribes. In others, such as the Dakota material, cultural food traditions seem to have provided a year-round source of vitamin C. The additional significance of these data is that some of the lesions in the skull are easily confused with those seen in anemia (e.g., porotic hyperostosis of the orbital roof). Differential diagnosis is likely to be troublesome if careful attention is not given to those features that are distinctive of scurvy.

#### References

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Are Paleoindians too variable to be from one population: a test of a single migration origin. E.G. Ozolins, Department of Anthropology, University of New Mexico, Albuquerque, NM, 87131.

Many of the migration models currently used to explain the arrival of the first inhabitants into the

Americans suggest that they were derived from a single population. There has also been considerable discussion concerning how different Paleoindians appear from other, more recent, Native Americans as well as to each other. In this study I use a small sample of six, well dated Paleoindian cranial remains, from throughout North America, to test the hypothesis that the Paleoindians came from the same population.

I compare the variances from both male and female Paleoindians derived from thirteen measurements to the variances from five comparative populations. Since these populations were drawn from Howells' craniometric database, it is assumed that they represent known populations. In order to counteract problems of small sample size, the Paleoindian variances were compared to variances calculated from an equal number of individuals from the comparative populations by using a resampling methodology. The Paleoindian variances are compared to the distribution of resampled variances from the comparative populations. This was done both univariately and multivariately.

The results indicate that the variances of the male Paleoindians are not any greater than would be expected from randomly drawn samples from a known population. A slightly higher level of variation was present for the female Paleoindians. Since the sample of female Paleoindians encompass a larger geographic area than do the males, a possible explanation of this result could be *in situ* evolution after the initial dispersal of the first migration. I therefore conclude that there is not enough evidence to contradict the hypothesis that all North American Paleoindians are not from the same population.

Part of this research was funded by a grant from the Graduate and Professional Student Association from the University of New Mexico.

Analysis of an Archaic Burial (41YK2) from Yoakum County, Texas. R.R. PAINE, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock, TX 79409 and P.J. LEWIS, Duke University Primate Center, Durham, NC 27705

A human burial was discovered eroding from the windward side of a sand dune on private land in Yoakum County, Texas. The discovery was first brought to the attention of the Yoakum County Sheriff's department and then to the Texas Tech University Forensic Lab.

The burial was extremely fragmented and represented by the right side of the body. It was found in a flexed position with the head pointing east and the face looking north.

A field assessment determined this burial to be Native American. Red ocher was found throughout the midsection, and the teeth demonstrated significant occlusal wear. No diagnostic materials were located in association, although Paleoindian and Archaic lithics have been reportedly found in the immediate vicinity by local artifact collectors. The remains were in immediate danger of destruction. Therefore, we mapped, excavated, and moved it to the Forensic Lab at Texas Tech University for further analysis and dating.

A date and biological profile were generated for the

remains. Using  $^{14}\text{C}$  radiometric assay of bone samples, a date of ca. 3,000 BP was returned. This date places the burial in the late-Archaic for the Southern High Plains. A biological profile determined the individual to be a female of 25 to 35 years in age. While severe/chronic health problems were not evident, osteoarthritis was found on the lumbar region. Several caries were found on molars, the canines demonstrated enamel hypoplasia, and there was extreme occlusal surface wear of the dentition. In general, a health pattern common to the hunter/gatherer lifestyle was found.

The burial represents the second documented site, and the only known Archaic burial, from Yoakum County. Archaic burials on the Southern High Plains are rare, and the remains from Yoakum County represent a significant resource in the study of Archaic period culture. The burial has been returned to the county for reburial.

Was *Kenyapithecus africanus* a sclerocarp feeder? An exploration of the dietary adaptations of a middle Miocene hominoid through anterior dental microwear analysis. A.K. PALMER, B.R. BENEFIT, and M.L. MCCROSSIN Southern Illinois University, Carbondale, IL 62901.

McCrossin and Benefit (1993, 1994, 1997) have suggested that *Kenyapithecus africanus*, a semi-terrestrial hominoid from the middle Miocene deposits of Maboko Island, Kenya, possessed a suite of morphological adaptations (procumbent lower incisors, robust canines, and a proclined symphyseal axis) extremely similar that of extant pitheciines (*Cacajao*, *Chiropotes*, and *Pithecia*). Pitheciines utilize their specialized anterior dentition to exploit a hard object sclerocarp diet. A preliminary study of posterior dental microwear analysis (DMA) supports interpretation of *Kenyapithecus* as a hard object feeder (Palmer et al., 1998), but does not reveal whether it emphasized incisal biting to open hard fruits. In this study, standard DMA (e.g. Ungar, 1992) of the incisors is used to compare microwear features of *Kenyapithecus* with that observed for a sample range of wild shot primates with diverse dietary preferences in the collection of USNM.

*Kenyapithecus* anterior microwear was found to be similar to that of pitheciine monkeys. *Kenyapithecus* and the pitheciines exhibit similar numbers of mean scratch features: *Pithecia monachus* (69), *Kenyapithecus africanus* (64), *Chiropotes satanas* (61), *Pithecia pithecia* (55) and *Cacajao melanocephalus* (52). However, while the mean scratch width of *Kenyapithecus* (1.59  $\mu\text{m}$ ) was similar to that of *Cacajao* (1.06  $\mu\text{m}$ ), it was wider than that of *Chiropotes* (.83  $\mu\text{m}$ ), *P. pithecia* (.69  $\mu\text{m}$ ), and *P. monachus* (.5  $\mu\text{m}$ ). These results suggest that *Kenyapithecus* emphasized incisal processing of hard foods, but that the dietary items it consumed were even harder than that eaten by extant pitheciines. Comparison with other extant primate incisal microwear is discussed.

Supported by Sigma Xi, AAUW, and UWPA.

A strategy for the morphometric analysis of the skull: implications for macaques. R-L. PAN and C. E. OXNARD, University of Western Australia, WA, 6907, Australia.

Cranial and dental measurements are often used in cladophylogenetic assessments. This study reports a strategy involving nested investigations of measurements from 11 macaque species (325 specimens, sub-equal sex groups). First, a series of local anatomical regions were examined: the sizes and shapes of (a) mandible, lower teeth and upper teeth each separately, (b) lower face and upper face each separately, and (c) external cranium and internal cranium also each separately. Second, data from these local regions were aggregated into functional suites: (a) masticatory apparatus, (b) face, and (c) cranium. Third, these functional suites were then aggregated into the whole skull.

Each aggregated suite, masticatory apparatus, face and cranium, gave the same result as their contained sub-units. However, each of functional suites provided a different view of species groups and sex sub-groups.

For example: species size differences (the major difference between the various species) and sex size differences (the major differences between the sexes) are orthogonally aligned. Size is never concentrated into a single principal component. In the masticatory apparatus species size differences are in the first principal component and sex size differences in the second. In the cranium this is reversed. In the face, the two sets of size differences are orthogonal but each is oblique to both components.

In the final data aggregation into the skull as a whole, the arrangement in the first two principal components mirrors the pattern in the masticatory apparatus. However, the information from the data in the other two regions is clearly still present and relatively independent: the third and fourth components also now being important.

These results imply caution when using these techniques with fossils where only small numbers of variables and few anatomical regions may be available. They also indicate that size differences and sexual differences are complex phenomena that should not be viewed simplistically.

Supported by Australian Research Council, Australian Academy of Sciences, Human Biology Centre and Chinese Academy of Sciences (Kunming Zoology Institute).

The effects of postural regulation on the hand-use patterns of free-ranging white-faced capuchins (*Cebus capucinus*) in Panama. M.A. PANGER, Dept. of Anthropology, University of California, Berkeley, CA 94720, and L.D. WOLFE, Dept. of Anthropology, ECU, Greenville, NC 27858.

Recent research indicates that free-ranging capuchins exhibit a right-handed trend for behaviors requiring a high degree of postural regulation (Panger 1998). The primary aim of this project was to further examine the potential influence of postural regulation on capuchin hand-use patterns. Postural regulation and its influence on hand preference in nonhuman primates has never been directly tested under free-ranging conditions.

Two months (from May 18-July 17, 1998) were spent on BCI, Panama, collecting data on 10 white-faced capuchins (*Cebus capucinus*) (4 adult males/ 6 adult females). Over 215 contact hours were spent with the monkeys, and a total

of 1315 unimanual behaviors were observed and recorded by one of the authors (MP).

Because of the short duration of the project and the relatively dense vegetation on BCI, data were collected using opportunistic follows. A variety of unimanual behaviors were examined, including carry-vertical (CV) and carry-horizontal (CH). Each time a unimanual behavior was observed during a follow, it was recorded along with the hand used, the estimated height of the monkey above the ground, and the object involved. In addition, because CV and CH involve substantial postural regulation, the posture (i.e., tripodal, bipedal, quadrupedal) of a monkey performing these behaviors was also recorded.

Initial analysis shows that the hand-use patterns of free-ranging white-faced capuchins on BCI, Panama, (a humid tropical forest) are very similar to those from white-faced capuchins living in Palo Verde, Costa Rica, (a dry tropical forest) (Panger 1998). The exception to this involves the "carry" (CV and CH) data. Unlike at Palo Verde, no clear right-handed trend was observed for "carry" during the study on BCI. Therefore, this study did NOT support the hypothesis that postural regulation influences hand-use patterns in free-ranging capuchins.

We would like to thank OTS, STRI, and the Mellon Foundation for helping to make this research possible.

Hormonal and anthropometric markers of lifestyle in Nepali and Ethiopian children.

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In recent years, hormonal research in human populations has rapidly expanded to include data on non-Western populations as well as data on young children. To date, the challenges are to investigate cross-culturally 1) the range of hormonal variation, and 2) the links between orthodox health indicators, such as measures of growth status, and the more elusive endocrine measures of well-being.

Research on street-children that includes biological indicators of health and well-being, and that uses appropriate control groups to evaluate alternative lifestyles is surprisingly limited. We present the findings of a recent study contrasting homeless street-children, slum-dwelling children, and middle class children, in Ethiopia. In total, 322 8-14 year olds participated in cross-sectional anthropometric, cardiovascular, and salivary cortisol measures, while a smaller sample of 60 children offered longitudinal cortisol samples. The methodology mirrored that of a comparative study of street, slum, school, and village boys in Nepal measured for growth ( $n=307$ ) and cortisol ( $n=804$  morning values for 104 boys).

Our results for both countries show that, in terms of stunted growth and wasting, homeless street-children are not the most disadvantaged group relative to children living with their families in poor areas. Cortisol data reveal both blunted and hyper-variable individual profiles in response to significant stressors of the street environment.

Craniometric discrete trait variation in *Gorilla gorilla*. P.B. PARK<sup>1</sup>, S.R. LEIGH<sup>1</sup> and L.W.

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The distribution of variation within *Gorilla* has remained a matter of active inquiry throughout the last century. Coolidge's taxonomic revision of the genus in 1929 brought much needed order to this field, and set the stage for contemporary investigations. The level of taxonomic diversity in gorilla is now an even more interesting problem in light of recent controversies regarding interpretations of molecular and morphological lines of inquiry. Consequently, we explore the distribution of morphological variation in *Gorilla* based on analyses of discrete traits. These data allow investigation of the robustness of generally accepted morphological taxonomies below the species level.

Discrete cranial traits representing all components of the crania are scored for a large sample representing the three commonly recognized subspecies of *Gorilla gorilla*. These traits are subjected to traditional analyses of frequency data. In addition, we model the data based on a threshold liability approach. Liabilities are estimated with the Gibbs sampler, a Monte Carlo Markov Chain estimator. We then use these liabilities to calculate multivariate measures of distance among taxonomic units. In effect, this method permits us to convert discrete data to interval-level data, opening a variety of numerical taxonomic approaches to systematic problems.

Analyses of discrete traits indicate clear separations among subspecies of gorillas. Specifically, western lowland and eastern lowland gorillas are the most clearly distinguishable. Sample sizes of mountain gorillas are very small, complicating interpretations, but show distinctions from the other subspecies. We evaluate the possibility that other subspecies are recognizable. Finally, the implications of these results for our understanding of subspecific variation in *Gorilla* are discussed.

This research was supported by the University of Illinois.

Sexual Dimorphism in two Byzantine populations from Jordan. N.A.PARKER, Natural Science, Hampshire College, Amherst, MA 01002

The Byzantine Period, particularly in Jordan, is not well understood. While many Byzantine architectural features have been excavated and studied, questions regarding the health, diet and demography of Byzantine communities remain.

This study examined sexually dimorphic traits in long bones. The study population came from two tombs and one cave tomb found at the site of a small wine-making community in Saiad, Jordan (circa AD 700). The sample size ranges from 25 to 50 depending on the long bone measured. The burials were completely commingled and use of the tombs lasted over an unspecified amount of time.



Methods for the data collection entailed 48 measurements on six long bones. These measurements included the width and breadth of the semi-lunar notch of the ulna, epicondylar breadth of the humerus, least circumference of the fibula shaft, among others. The sample sizes for the bones are as follows: humerus (58), radius (47), ulna (78), femur (34), tibia (44) and fibula (106).

Analysis of these data suggest that this population exhibits clear dimorphic traits in some of the long bones. For example, in the fibulae, dimorphism in size was associated with dimorphism in occupational stress markers and related inflammation suggesting strong patterns of division of labor.

The poster presentation focuses on the relationship between sexual dimorphism in the long bones, occupational stress, and division of labor, all areas previously unexplored for Byzantine populations.

This research was supported by a Hampshire College Howard Hughes Medical Institute Award.

Subtracting human genomes using Representational Difference Analysis (RDA).

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Representational Difference Analysis (RDA) is a molecular method for the identification of restriction fragments that are unique to one sample of genomic DNA (Lisitsyn, Lisitsyn and Wigler, 1993). First, a "representation" or amplicon is created from the two DNA samples to be subtracted, in order to reduce the complexity of the human genome and allow the hybridization steps to go to completion. Once the representation is obtained, one of the DNA samples ("tester") is denatured and hybridized to an excess of another DNA sample ("driver"). After three cycles of subtraction, the result is generally the identification of a restriction site polymorphism in which one allele is unique to the "tester" sample.

One interesting application of this subtractive methodology in the field of human population genetics is the identification of Population-Specific Alleles (PSAs). In this case, pools of individuals corresponding to different populations are used for the construction of the amplicons, and the subtraction process results in the enrichment of markers that are specific to the "tester population". We have recently performed RDA experiments in which we have subtracted a Nigerian *Bgl* II amplicon from a European-American *Bgl* II amplicon and vice versa. After three rounds of RDA subtraction we have isolated eight difference product fragments that are unique to the Nigerian amplicon and four that were unique to the European-American amplicon. We discuss the utility of RDA as a powerful method for the isolation of PSAs and emphasize the potential application of this molecular technique for the identification of loci associated with disease status.

Dental health in nineteenth century Rochester, New York: as evidenced by skeletons from the Highland Park Cemetery.

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In 1984, the Monroe County Department of Parks uncovered skeletal remains while expanding a public facility in Rochester, NY. The cemetery was excavated by the Rochester Museum of Science and has become known as the Highland Park Cemetery. Based on historic records, it appears that this cemetery was associated with the Monroe County Poorhouse and was in use from approximately 1826 to 1855. As part of a continuing assessment of the health and quality of life of the inmates of the poorhouse, this study focuses on their dental health.

Ninety-eight male and seventy-five female adult skeletons were examined to determine the overall dental health status of the individuals. Data were recorded on the following: the incidence and location of dental caries; involvement of apical abscesses; presence of enamel hypoplasia; severity of periodontal disease; and degree of enamel attrition. Of the 1,800 teeth present in the male skeletons, 25.4% had carious lesions, of which 33.0% were located at the cemento-enamel junction (CEJ). There were 1,409 teeth associated with the female skeletons. There was a higher incidence of dental caries (37.3%) in the females with over 90% occurring in the pits and fissures of the occlusal surface. A total of 139 apical abscesses were observed in the male jaws and 81 in the females. In both sexes, enamel hypoplasia involved approximately 4.0% of the teeth. In general, males showed greater severity of periodontal disease than seen in females. The recession of alveolar bone and the subsequent exposure of the CEJ probably accounts for the higher incidence of caries at this location in the males.

The overall dental health of the individuals associated with this nineteenth century poorhouse is probably not unlike that of the general population.

The femur is mightier than the tibia: inferring activity levels using limb bone cross-sectional properties. O. M. PEARSON and D. E. LIEBERMAN, Department of Anthropology, The George Washington University, 2110 G St, NW, Washington, DC 20052.

Cross-sectional properties of limb bones are frequently used to infer activity levels of recent and fossil hominid skeletal remains. However, do all limb bones preserve equal amounts of activity-related information? If not, which bones are better for making such inferences?

This study tests the hypothesis that proximal limb elements are better indicators of levels of mechanical loading than more distal elements because of a trade-off between growth and repair responses in the skeleton. Because the kinetic energy cost of adding mass is exponentially higher in distal portions of a limb, proximal limb elements are predicted to respond differently than distal elements to mechanical loads. In most cases, proximal elements should respond to mechanical loading through increases in cross-sectional diameter and mass (modeling). In contrast, distal

elements should respond to mechanical loads with proportionately higher rates of Haversian remodeling.

We tested the model experimentally using domestic sheep. A sedentary control group was compared to individuals who were trained to trot on a treadmill for an hour a day for three months. Comparison of the cross-sectional properties and histology of the bones demonstrate a trade-off continuum in responses: proximal limb elements had proportionately higher rates of modeling and very little Haversian remodeling, whereas distal elements had proportionately lower rates of modeling and higher rates of Haversian remodeling.

A similar trade-off between modeling and remodeling may also apply to the hominid skeleton. This hypothesis was tested using human male midshaft dimensions of the femur, tibia, and first metatarsal, corrected for body mass and limb length. In agreement with the experimental data, femoral midshaft dimensions were found to be more reliable than tibial dimensions as predictors of "hunter-gatherer" versus "sedentary" lifestyles.

We conclude that proximal elements are preferable when using cross-sectional properties to make inferences about activity patterns. In addition, biomechanical interpretations of the cross-sectional geometry of limb bones need to be integrated with histological data whenever possible.

Supported by NSF IBN-9603833 to D. E. Lieberman.

Burials from an historic Hudson Bay Company cemetery at Fort Frances, Ontario: a case study in applied forensic osteology. T.R. PECKMANN, Dept. of Anatomy, University of Cape Town, Cape Town, South Africa, 7925.

On October 24, 1984, the Boise Cascade Paper Company unearthed the remains of human burials at Fort Frances, Ontario during the construction of a parking lot. Eventually, thirteen individuals were discovered in twelve burial locations at the site. Three burial styles were found: extended burial in a coffin, flexed burial with no coffin, and bundle burial (Rajnovich, 1985). The Boise Cascade site is now attributed to the post-contact period in North America with remains, dating from 1817 to 1880.

On historical grounds, it is known that the cemetery at old Fort Frances is eclectic, and that the European, Aboriginal, and Metis inhabitants of the fort used the cemetery to bury their dead. The initial goal of the study is to assess basic forensic parameters of each individual, as well as gross and radiographic observations of skeletal pathologies and anomalies. In addition, the skeletons are subjected to stable isotope analysis to determine whether and to what extent, nutritional status can be determined.

Isotopic data from three comparative sites, Brazier, Kleefeld, and Morden are presented, in addition to the results from DdKi-2, to analyse for diet composition. For each archaeological site, the  $C_4$  diet potential is presented rather than the  $C_3$  composition as the former is employed by the majority of authors researching isotopic diet potential (Ambrose 1992; Katzenberg 1984; Schoeninger *et al.* 1984, 1985).

This analysis reveals small amounts of  $C_4$  plants being consumed by all individuals and hence, confirms a  $C_3$  diet. Due to the absence of flora and faunal samples for all of the above mentioned sites, all percentages and possible diet

compositions illustrated are based on flora and faunal samples presented in Ens (1997); micro-regional variation and a limited baseline prevent the distinction of races based on diet composition.

Cultural Modification of Bone: A Study of Cutmark Morphology, Location, and Orientation on Human Remains from Northern Mexico. V.R. PEREZ, Department of Anthropology, University of Massachusetts Amherst, MA 01003 and D.L. MARTIN, School of Natural Science, Hampshire College, Amherst, MA 01002.

Cutmarks provide valuable insight into perimortem and postmortem treatment of human remains. In deciphering the patterning and tools used to produce the cutmarks, it is possible for interpretations of social behavior to be inferred. The location and morphological characteristics of cutmarks can be used to distinguish between butchering practices such as dismembering, skinning, or filleting and warfare/violence.

This poster presents our research on the analysis of cutmark morphology and patterning from disarticulated remains recovered from La Quemada in Zacatecas, Mexico. La Quemada (c. AD 600-900) is a large site with notable public architecture that was a regional sociopolitical and ceremonial center.

Cutmark morphology was examined through an analysis of positive casts made from the human remains.

Histological analysis of sections of the casts cut perpendicular to the orientation of cutmarks provided detailed information on the depth, shape and thickness of the marks, and in some cases, this suggested the type of tool used for cutting (e.g., obsidian and rhyolite).

Results demonstrate that the shape, location, and orientation of these cuts are consistent with butchery (Binford, 1981). Encircling patterns around the femoral head, cuts near the condylar region of the distal humerus and just below the head of the proximal humerus, along with cuts near the neck of the radius all support a processing technique that included dismembering and defleshing. Disarticulated remains from different contexts (temples, banquettes and middens) show some variability in techniques both by implement used and pattern of processing suggesting a difference in status or "social persona" among the individuals examined.

Supported by a Wenner-Gren Grant (#6253), Dr. Ben Nelson at the U. of Arizona, Tempe, and the Hampshire College Southwest/Mexico Field Studies Program.

Trace elements in dental enamel as an indicator of dietary change in an Oneota population. E.A. Petchenkina, Department of Anthropology, University of Missouri-Columbia, MO 65211.

Paleoethnobotanic and stable isotope data suggest a high dietary importance of maize for a

Protohistoric Utz site from Saline county, Missouri, from Oneota culture. The easily available high quality weaning food resulted in early average weaning age as estimated by distance of linear enamel hypoplasias to cemento enamel junction.

Twenty four dental sets from the Utz site are analyzed for the microelement composition in order to estimate the childhood diet. The second permanent molar, whose enamel calcifies primarily between birth and 6 years of age, is used to estimate early childhood diet. It is compared to the microelement composition of third permanent molar enamel and cortical bone, in order to determine dietary change over time.

The correlation of microelement composition of the dental enamel with age at death as well as with non-specific indicators of stress, such as presence of linear enamel hypoplasias, porotic hyperostosis, cribra orbitalia, and achieved stature, suggest a significant influence of the early childhood diet on adult health.

Capture, health, and morphological assessment of free-ranging mantled howler monkeys (*Alouatta palliata*) in Nicaragua. G. PETER, Parke-Davis Research, Ann Arbor, MI, R. SOHN, Wildlife Veterinary Consulting, Salt Lake City, UT, and L. WINKLER, University of Pittsburgh, Titusville, Pa 16354.

This paper describes the preliminary results of an interdisciplinary project on free-ranging mantled howler monkeys on Ometepe Island in Lake Nicaragua. This project is unique in being the first in Nicaragua to assess the health of these biogeographically isolated monkeys. Eleven mantled howler monkeys (10 adults – 5F, 5M and 1 subadult F) in a group composed of 13 adults were captured, marked and released over a 4 day period in late July, 1998. Capture was affected with the Pneu Dart® capture system delivering 120 mg of a combination of tiletamine and zolazepam (~20 mg/kg). Unconsciousness occurred rapidly (1-4 minutes) with a mean recovery time of  $2.53 \pm 0.56$  hours. During the period of restraint, each animal was given a thorough physical examination, blood feces, and hair obtained, and information gathered on temperature, heart and respiration rates, body weight, morphology (sitting height, tail length, upper and lower limb components (Schultz 1929)), dental morphology, and estimates of age and reproductive status. Overall the health of these animals was excellent. Mean body weights were  $4.86 \pm .34$  (females) and  $6.23 \pm .10$  (males). Palpation indicated three females were pregnant. Hematology performed in the field revealed median values for WBC (6,660), RBC ( $4.09 \times 10^6$ ), and PCV (40%). ELISA for measles and IFA for EEE, VEE, yellow fever, dengue, herpes platyrrhinus, and leptospirosis indicated no exposures. Plasma, serum, blood smears and clots were retained for later analyses (DNA isolation, serum chemistries, differential blood counts, blood parasites exam). Feces were also collected in 10% formalin for parasitic ova examination and Giardia antigen detection.

Results of these analyses will be reported. Our results will be compared and discussed in relation to other capture projects from other locales (Glander et al., 1991).

Skeletal markers of therapy and custodialism in a 19<sup>th</sup>-century asylum. S. M. PHILLIPS, University at Albany, State University of New York, Albany, NY 12222.

The purpose of this paper is to investigate the biological consequences of long-term institutionalization. In North America, long-term institutionalization first became commonplace during the mid 19<sup>th</sup>-century. The current bioarchaeological literature on skeletal samples from 19<sup>th</sup>-century institutional contexts, for the most part, represent individuals with short-term institutional experiences (i.e. poorhouses and the military). This study examines two skeletal samples; one associated with long-term incarceration and one associated with short-term care. During the latter half of the 19<sup>th</sup>-century, therapy in long-term institutions constituted intensive labor regimens for inmates, regardless of age or sex. To test for the effects of this therapy, measures of cortical maintenance and long-bone robusticity are presented and compared with skeletal samples from varying contexts.

The Oneida County Asylum skeletal sample (n=100) and the Albany County Almshouse (n=40) skeletal sample comprise the bulk of the original data offered in this study. In addition, documentary materials concerning institutional diet, therapeutics, labor activities, and other socio-historical data were included for analysis. Cortical maintenance was determined from magnified photographic images of femoral cross-sections projected onto a digitizer screen and traced with a stylus. Long-bone robusticity indices were calculated from standard osteometric observations.

This study suggests that long-term institutionalization during the 19<sup>th</sup>-century, depending on the nature of therapeutic methods, resulted in increased robusticity and cortical maintenance among the inmates. In addition to activity patterns, evidence of the custodial care of disabled individuals is also visible in skeletal samples associated with long-term institutionalization. These findings demonstrate the fine tuning of biocultural models through the linkage of skeletal series and socio-historical data.

This project is supported by a Graduate Fellowship from the University at Albany, SUNY; a Research Associate appointment at the New York State Museum; a Research Residency at the New York State Library; and was improved with technical support from the University of Texas Health Science Center.

Patterns of affiliative grouping behavior, aggression, and reconciliation in rhesus (*Macaca mulatta*) and pigtailed monkeys (*M. nemestrina*). H.A. PIELET and M.R. CLARKE, Dept. of Anthropology, Tulane University, New Orleans LA 70118.

Observations were carried out from May to November, 1997, to evaluate species differences in grouping behavior,

aggression, and reconciliation between rhesus and pigtailed monkeys. Subjects were housed in 4 field cages (2 rhesus, 2 pigtailed) at the Tulane Primate Center in Covington LA, and these social groups consisted of unrelated adults and offspring. Observations were a combination of scan sampling (20 min. intervals) and focal sampling, for a total of 102.25 hours (84.25 summer, 18 fall). Fall data were collected to determine if patterns changed in the seasonal (rhesus) vs. nonseasonal (pigtailed) breeders.

The complete data set was analyzed using Chi square tests. Observations for summer and fall were analyzed in a similar manner. Results for each group were corrected to reflect similar group and corral size.

There were significant differences in the size of subgroups (Chi square= 55.8119,  $p<.01$ ). Pigtailed monkeys were more frequently found in larger than expected subgroups (4 or more), while rhesus were found more frequently in smaller than expected subgroups. This result was consistent in all analyses.

There were no differences in rates of aggression by species (Chi square= .222, n.s.) or by group size (Chi square= .8889, n.s.). There were significant differences by density (Chi square= 9.83,  $p<.05$ ): Aggression decreased as density increased. Reconciliation was minimal, occurring once for each species.

Pigtailed monkeys are found in larger subgroups than rhesus monkeys. This pattern is not affected by social group size, space available, or season of the year. In the absence of reconciliation, aggression is reduced in both species in more "crowded" conditions.

Supported by NIH Grant # RR000164 to the Tulane Regional Primate Research Center and grant from the Kenneth J. Opat Fund, Dept. of Anthropology, Tulane University.

A multivariate craniometric study of the Ryukyu Islanders and their relationship with the prehistoric and modern peoples of Japan, Asia, and the Pacific. M. PIETRUSEWSKY, Department of Anthropology, University of Hawai'i-Manoa, Honolulu, HI 96822.

The Ryukyu Islands have long attracted the attention of anthropologists. The culture, language, and other aspects of Ryukyu Islanders differ noticeably from the inhabitants of the main Japanese islands. Humans have lived in the Ryukyu Islands for at least 30,000 years, but their exact origins and relationships to the rest of the Japan and neighboring regions remain unclear.

Multivariate statistical procedures, Mahalanobis' generalized distance, stepwise discriminant function analysis, and various clustering algorithms, are applied to 29 measurements recorded in prehistoric and more recent crania from the Ryukyu Is., the main islands of Japan, and surrounding regions to investigate the biological relationships and the possible origins of the Ryukyu Islanders.

Separate multivariate analyses indicate a close connection between Okinawa and Amami Islands and the relative isolation of the southern Sakishima group of the Ryukyu Is. Broader comparisons demonstrate an unexpected connection between the Ryukyuan series and Kamakura, the alleged victims of the battle which took place in this city in 1333. In turn, these are related to the Yayoi and Kofun

cranial series. Other connections include one between modern Ainu and prehistoric Jomon and another which groups all modern Japanese since the Edo Period. When these same cranial series are compared with 43 additional cranial series representing East Asia, Southeast Asia, Australia, and the Pacific (2,582 male specimens), the Ryukyu series again aligns with Kamakura, Yayoi, and Kofun, well separated from the remaining more recent Japanese series. The latter connect to northeast Asian series. Ultimately, all the Ryukyu series fall within an East Asian/Northeast Asian constellation, which is well separated from Southeast Asia and the cranial series representing Polynesia, Melanesia, and Australia. The results support an Ainu-Jomon connection but not an Ainu-Ryukyu association. Overall, these new craniometric results suggest a close affinity between the present day inhabitants of the Ryukyu Islands and northeast Asians.

This research was supported by the International Research Center for Japanese Studies, Kyoto, Japan (1997-1998).

Cultural taphonomic alterations in several formative populations from the Mexican Basin. CM PIJOAN, Dirección Antropología Física, Instituto Nacional de Antropología e Historia, México, D. F. 11560

Several skeletal populations from the Mexican Basin of the formative period show different cultural taphonomic alterations. In particular, the bones from Tlatelcomila, Tetelpan (500-300 BC) and Cuicuilco (600 BC-200 AD), in México City, and Tlapacoya-Zohapilco (Ayotla, Manantial and Tetelpan phases - 1250-700 BC) and Tlatilco (1100-400 BC) in the state of México, show cut marks, intentional breakage, thermic alterations, pot polish and percussion striae in different expressions. As well, there are several instruments manufactured from human bones.

Using the technique proposed by Pijoan (1997), we will locate all of these alterations and register them on a graphic cedula, so that we will be able to determine the pattern of expression in each population. Based on these patterns, we will analyse the different taphonomic alterations that the skeletal materials from these sites present, compare them and try to determine the events that caused them.

Infant diseases in pre-Columbian Mexico: The urban population from La Ventilla-Teotihuacán. - C.M. PIJOAN AGUADE, Dirección Antropología Física, Museo Nacional de Antropología (Mexico), M. SCHULTZ, Center of Anatomy, University of Göttingen (Germany), T.H. SCHMIDT-SCHULTZ, Center of Biochemistry, University of Göttingen (Germany) and J. MANSILLA LORY, Dirección Antropología Física, Museo Nacional de Antropología (Mexico).

La Ventilla is a part of the old city of Teotihuacán which in the Classic Times, represented the huge capital of a mighty empire. Causes and frequencies of deficiency and inflammatory diseases in infants and children were studied



over a period of years. A total of 163 well preserved skeletons which were excavated from living areas of La Ventilla-B and La Ventilla-92/94 were investigated by macroscopic, radiological, endoscopic, light and scanning-electron microscopic techniques. The results provide insights into pre-Columbian living conditions such as nutrition, hygiene and the care of small babies and infants but, in particular, into infant morbidity and mortality. Very probably, all the children who were buried in the same settlement area were close members of the same family, because the frequency of congenital malformations in the vertebral column is extremely high. It is interesting that the nature and frequencies of diseases differ between these two different areas of La Ventilla. In both populations, there is evidence of deficiency diseases such as anemia and scurvy, but the frequencies are higher in the children from La Ventilla-92/94. Microscopic investigation reveals that the frequency of the vestiges of inflammatory meningeal reactions was not as high as had been diagnosed earlier by macroscopic techniques alone, but meningitis was still present. Although the percentage of small babies and young infants is not low in the population of La Ventilla-B, this age group predominates more in the population of La Ventilla-92/94: In La Ventilla-B, most of the children died before the age of two (approximately 80%), in La Ventilla-92/94 the mortality was even higher (approximately 90%). Particularly, in the population from La Ventilla-92/94 the mortality at the fetal age was high. Thus, pregnant women must have been subjected to great physical stress (e.g. hard labour). In summary, the people from La Ventilla are characterized as members of the lower social class, living partly in conditions comparable, with regard to state of health to people living today in slum areas of large cities.

The relation of handedness on asymmetry in the occlusal morphology of first permanent molars.

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Handedness has been shown to be related to a number of systematic asymmetries in body dimensions, dermatoglyphic patterns and cerebral morphology. The aim here was to compare linear and angular tooth crown component asymmetries of the permanent molars in healthy right-handed and left-handed subjects.

The material comprised 27 children with recorded concordant left-side dominance of hand, eye and foot. The controls were an age- and sex-matched group with right side dominance. The material is based on the Collaborative Perinatal Project where the dentitions and exact medical records of over two thousand children were examined. Machine vision technique was used to

gain accurate 3D-information from the occlusal surfaces of the first permanent upper and lower molars. Fluctuating asymmetry did not differ significantly between the examined groups for linear variables. The directional asymmetry values of most angular measurements of mandibular first molars indicated for asymmetry of opposite direction between the two examined groups. The results indicate that the effect of handedness is to a small degree affecting the occlusal morphology but the magnitude is so weak that the phenomenon can only be seen in the angular measurements of the maxillary molars. Supported by grant No: 1-NS-2-2302 from National Institute of Neurological Disorders and Stroke.

Taxonomic patterns of craniofacial dimorphism in anthropoids. J.M. PLAVCAN, Department of Anatomy, NY Coll. Osteo. Med. Old Westbury, NY 11568.

Sexual dimorphism is widely recognized as an important component of intraspecific variation in primates that confounds attempts to identify and discriminate among species in the fossil record. Some evidence has been put forward that patterns of craniofacial dimorphism vary among primates, offering the hope that interspecific patterns of dimorphism might be helpful in evaluating the biological and taxonomic significance of variation in the fossil record. However, species representation for most studies has been relatively small. This study evaluates patterns of craniofacial variation in a large set of anthropoid primates.

Craniometric data from 40 dimensions were gathered for 70 species of anthropoid primates, for a total sample of 1579 specimens. Data were gathered only from wild-shot specimens of known sex from restricted geographic ranges, minimizing intraspecific variation. Estimates of body mass were taken from field data, Plavcan and van Schaik (1997), and Smith and Jungers (1997). All data were ln-transformed for analysis.

Most measures are strongly correlated with mass dimorphism. Simple univariate and bivariate comparisons show significant variation in the pattern of dimorphism among species, with clear differences between platyrrhines, cercopithecines and colobines in many bivariate comparisons. PCA of all dimensions shows PC I strongly correlated with mass dimorphism, with other axes showing significant differences among taxonomic groups. Canonical variates analysis treating species means as individual points shows clear differences between colobines, platyrrhines and catarrhines in the pattern of craniofacial dimorphism. Within genera, canonical variates analysis using individual specimen values suggests that the pattern of dimorphism is more uniform among species. The results suggest that patterns of dimorphism may be helpful in discriminating species in the fossil record.

Funded by NSF grant SBR-9616671.

Gorillas, guerillas, bugs and bushmeat: the current status of gorillas and threats to their existence. A. PLUMPTRE, A. MCNEILAGE and J. HALL, Wildlife Conservation Society.

The current status of two of the three subspecies of gorilla is fairly well known; Gorilla gorilla beringei (mountain gorilla) and Gorilla gorilla graueri (eastern lowland gorilla) with populations of around 600 and 17,000 respectively. Mountain gorillas occur only in two protected areas, the Virunga volcanoes and the Bwindi Impenetrable National Park. Recently some research has suggested that the Bwindi gorillas should be considered a separate subspecies. Eastern Lowland gorillas occur in the Democratic Republic of Congo (DRC, formerly Zaire) from Mt Tshiberimu south to the Itombwe massif, but 67% of the population is found within one of the national parks. The status of Gorilla gorilla gorilla (western lowland gorilla) is less well known with the only country-wide census having taken place in Gabon. However it is estimated that there are about 110,000 distributed from the republic of Congo to Nigeria.

The threats to these animals vary between countries but can basically be attributed to civil war, bushmeat hunting and habitat loss and fragmentation. For the eastern subspecies civil war in Rwanda, Congo-Zaire and Uganda have led to losses in the populations. However these losses do not appear to have been as great as had been feared - where it has been possible to monitor habituated groups there have been a few losses as a result of the war but there have also been several births over the same period. A possibly greater threat for these animals is poorly managed tourism. There have been many cases of the rules limiting contact between people and gorillas being broken, leading to an increased threat of introducing potentially fatal diseases to habituated groups and in turn to the whole population. Given the poor security in the region and the inability of vets to visit parts of the parks this threat could have a major impact on the populations. Western lowland gorillas are threatened by the flourishing bushmeat trade in most of the countries in which they are found. Around 1,200 tonnes of bushmeat are consumed in Cameroon, CAR, Congo, Gabon, Equatorial Guinea and DRC (Congo-Zaire) per year (or 645 kg/km<sup>2</sup>/yr). Gorillas only form a small percentage of this meat trade but where hunting is regular this species is one of the first to be eradicated. Bushmeat hunting is helped by the opening up of the forest by logging companies allowing greater access for hunters. Given the rates at which logging is proceeding in these countries it is likely that in future western lowland gorillas will only occur in national parks and only if these are well protected.

Environments of natural selection in early Pleistocene *Homo*. R. POTTS, Human Origins Program, NMNH, Smithsonian Institution, Washington, DC 20560

Environmental hypotheses of adaptive evolution are of three kinds: habitat-specific, seasonality, and habitat-variability hypotheses. The first emphasizes consistent, directional selection in a particular habitat type. The second considers key adaptations to result from recurrent seasonal shifting of resources. The third sees adaptive versatility to result from strongly inconsistent selection regimes, which have been heightened by episodic reshaping of habitats over long periods (variability selection). By

placing fossils and artifacts within paleoenvironmental sequences, these hypotheses and related processes of hominin adaptive change can partially be tested.

Fine-resolution geologic and paleoenvironmental data from Olorgesailie Members 1-12, Olduvai Beds II-Masek, and the Turkana basin show that dramatic landscape remodeling took place in East Africa over spans 10<sup>3</sup>-10<sup>5</sup> yrs long, due to climatic, tectonic and volcanologic causes. Long-term habitat remodelings differed qualitatively from recurrent seasonal shifts. Data from living mammals show, however, that seasonal unpredictability does contribute to selective inconsistency over time and space, thus helping to link individual-level selection to much larger disparities in selection over longer periods.

Environmental remodeling and selective inconsistency offer a powerful framework for adaptive models of early Pleistocene hominins. Environment-specific analogues, popular in some paleoanthropological circles, by contrast appear to have little relevance to behavioral evolution in early Pleistocene *Homo*. Instead, key behavioral-ecological developments (e.g., the likely effects of increased brain and body size, longer stone transport distances, use of more diverse environments) are consistent with the habitat-variability view.

New craniofacial and dental perspectives on Native American origins. J.F. POWELL, Department of Anthropology, University of New Mexico, Albuquerque, NM 87131.

A number of models of New World colonization and dispersal have been suggested by researchers using genetic, dental, and craniofacial databases, including one, three, or four waves of migration from the Old World. Although the genetic data have gained considerable attention, analyses of quantitative phenotypic variation in Paleoindian and Archaic human remains have the potential to resolve some of the questions involving the number of founding groups and the nature of post-colonization evolution in the Americas.

In this study I examined craniofacial and dental traits from affirmed North and South American Paleoindians (n = 18), dating from 8,500 - 11,700 yr B.P., as well as from a large sample of late Holocene comparative cranial (n = 3,629) and dental (n=2,140) data from populations around the Pacific Rim. Principle components scores for size-corrected data, subjected to multivariate analysis of variance, indicated that that Paleoindians are dentally and craniofacially distinct from both European (p= 0.0125) and modern Native American (p= 0.0130) populations, but not from northeast Asians (p= 0.0986) or Polynesians (p=0.8407). Within sample variation in the Paleoindian group was high for both cranial and dental traits; however, a Monte Carlo analysis of Paleoindian variation (sample n = 10) indicated that the heterogeneity of this early group was no greater than that obtained for samples of similar size drawn at random from comparative populations.

In addition to model-free approaches, the craniofacial data were used to generate pairwise minimum *F<sub>st</sub>* values, taking differences in sample size into account and using an average heritability of 0.55. Minimum *F<sub>st</sub>*s for Paleoindians and other continental divisions of humans were in the range of 0.11 to 0.23, with the smallest value obtained for the Native American comparison. Overall, the results suggest that a single wave of migration *could* be adequate to explain observed differences between Paleoindian founders and later descendants, depending on the timing of the colonization event.

Funded by University of New Mexico (RAC 97/107) and FAPESP

Effects of pregnancy and lactation on parameters of bone metabolism in the common marmoset monkey. R.A. POWER, C.P. JEROME, M.P. POWER, O.T. OFTEDAL, D.G. LAYNE, and S.D. TARDIF, Biological Sciences, Kent State University, Kent, OH 44242.

During pregnancy and lactation, the mother provides significant amounts of calcium to the fetus and neonate. The subsequent effects on maternal skeletal status have been examined in humans and Old World monkeys, as well as other mammals. Bone mass has been shown to increase or remain unchanged during pregnancy, and decrease during lactation. Biochemical markers of bone metabolism are significantly correlated with bone mass measurements, and reflect similar changes during pregnancy and lactation.

The effects of reproduction on maternal bone have not been examined in New World primates. Callitrichids are unique anthropoid primates relative to their reproductive strategy, having a relatively high and variable reproductive potential. Therefore, they provide a unique model in which the effects of pregnancy and lactation on maternal bone in primates may be examined and compared.

Currently, a longitudinal study is being conducted to examine changes in biochemical markers of bone metabolism and calcium balance across reproductive states in a sample of common marmosets. Serum and urinary biochemical markers are examined at baseline, during pregnancy, and during lactation. In conjunction, intestinal calcium absorption estimated from calcium balance trials is examined at baseline and during pregnancy. Preliminary data for 5 females indicate that urinary deoxypyridinoline/urinary creatinine (marker of bone resorption) increases during lactation above pregnancy and baseline, suggesting bone loss during lactation. Calcium absorption increases in pregnancy over baseline, suggesting a potential protective effect on maternal bone during pregnancy due to increased mineral absorption in conjunction with the hyper-estrogenic state of pregnancy. These preliminary data indicate that changes in maternal skeletal status during pregnancy and lactation are similar to those observed for humans and Old World primates.

This research is supported by NIH R01-RR02022.

Modification of Layer IVA of Primary Visual Cortex in Ape and Human Evolution. T.M. PREUSS, H-X QI, and J.H. KAAS. Div. of Behavioral Biology, Univ. of Southwestern Louisiana-New Iberia Research Ctr., New Iberia, LA 70560 USA (TMP), and Dept. of Psychology, Vanderbilt University, Nashville, TN 37240 USA (HXQ, JHK).

We compared the laminar organization of primary visual cortex (V1; area 17) of hominoids (5 humans, 4 chimpanzees, 1 orangutan), Old World monkeys (3 macaques, 3 vervets), and New World monkeys (3 squirrel monkeys, 2 spider monkeys). Paraformaldehyde-fixed occipital lobes were frozen-sectioned at 50  $\mu$ m in the coronal or horizontal planes. Series of sections were stained for Nissl and cytochrome oxidase (CO) using conventional histochemical techniques, and for calbindin (CalB; a calcium-binding protein) and nonphosphorylated neurofilament protein (NPNF) using immunocytochemistry. The orangutan tissue was obtained only recently, and has not yet been stained for CalB or NPNF.

In all taxa, cortical layer IVC stained densely for CO, and the Old World and New World monkeys had an additional CO-dense band in layer IVA. In the hominoids, however, layer IVA stained lightly for CO. Chimpanzees and humans also evinced a dense band of CalB immunoreactivity in layer IVA, while this layer was relatively lightly stained in Old World monkeys. The presence of a CalB-dense band in layer IVA of the New World monkeys, however, suggests that hominoids and New World monkeys share the primitive condition, while Old World monkeys are derived. Immunostaining for NPNF (with antibody SMI-32) yielded dense staining in layer IVB in all taxa. Additionally, humans (and only humans) exhibited substantial NPNF staining of layer IVA, with a characteristic pattern consisting of dark-staining zones encapsulating light-staining territories.

The reduction of CO staining in hominoid layer IVA suggests that the thalamic inputs to IVA (arising from the parvocellular retinogeniculate pathway), are less numerous or less active than in non-hominoids. Furthermore, the strong staining of human layer IVA for NPNF, thought to be a marker for the magnocellular visual stream, suggests that this pathway is enhanced in humans. This would accord with evidence that some higher-order human visual areas have stronger magnocellular representation than do their Old World and New World monkey homologues, and raises the possibility that humans possess specializations of visual motion perception, which is mediated by the magnocellular pathway. [Supported by the McDonnell-Pew Program in Cognitive Neuroscience (JSMF 98-45), NIH (EY02686), and the New Iberia Research Center.]

What makes a food contestable? Food properties and contest competition in vervets and patas monkeys in Laikipia, Kenya. JD PRUETZ and LA ISBELL. Department of Anthropology, University of Illinois at Urbana 61801; Department of Anthropology, University of California at Davis 95616.

A number of models have attempted to identify circumstances in which feeding competition among female primates will occur (Wrangham 1980, van Schaik 1989, Isbell 1991). We test the predictive value

of these models and identify characteristics of food items that promote contest competition among sympatric adult female vervet and patas monkeys in Laikipia, Kenya. Data on agonistic interactions were collected from June 1993-August 1995 during 37089 contact minutes with vervets and 34630 contact minutes with patas monkeys. A total of 154 contests between adult females over foods were observed (75 patas monkeys, 79 vervets). The distribution and abundance of the primates' foods were determined through a number of different vegetative sampling methods (e.g., absolute counts and presence/absence of food items, line transects, quadrats). Other variables such as primates' feeding behavior, nutritive value of foods, the availability of other foods, and processing costs of foods were also considered in order to determine when females should compete over foods. Results show that foods which were clumped in their spatial distribution and characterized by long food-site depletion times (e.g., relatively abundant at feeding sites), such as *Acacia* exudates and mushrooms, were those food types which monkeys most often contested. Protection by obligate *Acacia* ants of *A. drepanolobium* foods reduced the usurpability of foods high in nutritive quality for vervets and patas monkeys. In general, models of female social relationships which explain patterns of feeding competition are useful in predicting when contest competition should occur. However, variables such as those discussed here are instrumental in deciphering female social relationships at a more specific level.

Funding provided by Rutgers University Research Council and NSF grant SBR 93-07477 to LAI.

Diet and occlusal disease in ancient Egyptian skulls. P.-F. PUECH, G. SUSINI and R. NOTONIER, Faculté d'Odontologie à Marseille; BP 191, 30012 NIMES cx4, France.

Our ability to infer specific diet from tooth wear in fossil hominids has been hampered by the impossibility to distinguish between the causes of wear. In particular to understand the respective role of the anterior guidance in the protection of the posterior teeth, missing and carious teeth, bruxism, and abrasives. The purpose of this paper is to compare the amount of occlusal wear with diseases of teeth and periodontium in ancient Egyptians.

The data for this study was gathered from skeletons recovered at Gebelen and Assiout in Upper Egypt and at Assuan on the Egypt-Nubian border. The collection consists of 791 pre-dynastic and dynastic individuals and comprise negroid-featured Nubians and Egyptians (Davide, 1972). The amount of bone loss was measured from the cemento-enamel junction to the alveolar crest, the scale proposed by Scott (1979) was used to evaluate the degree of wear, the quantitative comparison of microwear involved measure-

ments of the number and size of the pits observed on SEM micrographs, osteitis was detected by the use of X-rays and the incidence of dental calculus was studied according to the scheme of Brothwell (1963).

Subdividing the series, the results disclose a significant difference between the lower frequency of caries with frequent incidence of dental calculus and high incidence of micro-striations from a village settlement at Gebelen and the higher frequency of osteitis and high incidence of pits in the subsample of the regional urban centre at Assiout. One possible clue to the cause of the relatively regular great dental wear observed in the covering period of 2500 years could be gained from the study of the geology of the habitation areas associated with the habit of chewing vegetable masticatories, a custom mentioned by Theophrastus: "All natives in Egypt chew papyrus uncooked, boiled or roasted. They extract the juice and spit out the quid." Teeth make minimal direct contact during the mastication of food, but grinding of the teeth part of everyday life has deleterious effects.

Accuracy of sex estimation of non-human primates using morphological traits of the pelvis. J.A. PULLEY, Department of Anthropology Arizona State University, Tempe, AZ 85281

Current debates regarding the sex of Plio-Pleistocene hominids have led researchers to focus on the methods used to estimate the sex of hominid fossils. One of the most accurate means of estimating sex in modern human skeletal samples is by examining the morphological traits of the pelvis. Whether these pelvic traits can be used as an accurate estimator of sex in Plio-Pleistocene hominids needs to be tested on a non-human primate sample.

Eleven morphological traits of the pelvis are examined for their ability to allow accurate sex estimation in a sample of non-human primates. Pelvic traits, which are commonly used to estimate sex in modern human populations, are examined in four non-human primate species from the National Museum of Natural History. The species include *Pan troglodytes*, *Gorilla gorilla*, *Pongo pygmaeus*, and *Hylobates muelleri*. The accuracy of the eleven morphological features used in the sex estimation of the NMNH sample was determined by calculating the total observed occurrences of each trait within each species. Individual pelves were recorded as either male or female for each of the morphological traits.

The results show that the methods of sex estimation of the NMNH sample, using the morphological traits of the pelvis, does not offer the same high level of accuracy that has been established in modern human skeletal samples. It is concluded that non-human primates do not share the same sexually distinctive pelvic features found in modern humans.



Using canonical variates and generalized distances on the postcrania of Qafzeh, Skhul, Cro-Magnon, Predmost, Taforalt, Neolithic French, Natufians, and recent moderns to assess populational affinities. C.B. QUINTYN, University of Michigan, Ann Arbor, MI 48109.

The postcrania have played a minor role in assessing morphometric affinities. Simultaneously, computer implementation of discriminant function and posterior probabilities have played a major role in the statistical analyses of the postcrania. But posterior probabilities have a built-in assumption that a particular specimen must belong to one of the reference populations being studied. This gives the specimen an inflated probability of group membership when, in reality, it is very distant or in a group not being studied (Albrecht 1992).

A total of twenty-six dimensions were measured on innominates (m=107/f=104), femora (m=187/f=184), and tibiae (m=189/f=147) of Qafzeh9, Skhul7,3,4,5,6,9, Natufian, Ohalo, Predmost, Taforalt, Neolithic French, and Cromagnon. In addition, the reference populations include Nubia, Somalia, Qid, Mali, Europeans, and S. Asia. Statistical analyses were carried out separately on each of the sex groups using various combinations of bones and measurements, i.e. femur+tibia, femur+innominate, tibia+innominate, and femur+tibia+innominate. Also, information about shape was obtained by using ratios of these measurements, i.e. platymetric, platycnemic, pilastric, and crural indexes. Between group structure coefficients were used to compute canonical variates on the data. No matter what combinations of long bones used, the canonical variates that were significant suggest (overwhelmingly) that size separated the groups with a small shape element. For e.g. all of the archaic moderns were distant from the recent moderns, regardless of sex, with distance probabilities or typicality probabilities of <0.001. Shape analysis using different combinations of the indexes suggest that the archaics are closer to each other with distance probabilities of 0.4. Transformation of variables into logarithms did not improve results.

This research confirms that (1) in shape/size archaic moderns in both sexes are distant from recent moderns; (2) these results reinforce what is already known from crania analyses, in fact, making postcrania a perfect substitute when crania are not available. Its role in morphometric assessment should be increased.

This work was partially funded by Irene Sala Levi Care Archaeological Foundation.

A bioarchaeological study of the late 17<sup>th</sup> century cemetery at Onondaga. C.A. RAEMSCH and T.R. JAMISON, Hartgen Archeological Associates, Inc., Troy, NY 12180.

In the past, few opportunities have existed for studying large Contact Period native cemeteries in the northeast. The excavation of a late 17<sup>th</sup> century Onondaga cemetery (the Pen Site) in the 1960s offered a unique opportunity for studying the effects of contact and cultural upheaval on the biology and culture of an Iroquoian group residing in central New York. However, minimal analysis of the site and associated materials was completed prior to a 1995 NAGPRA-sponsored inventory of the collection housed at the

Rome Historical Society in Rome, New York. This study focuses on interpreting the demographic, health, and cultural characteristics of residents of the Onondaga capitol within a defined time period (ca. 1682-1700).

A total of 120 individuals were disinterred from the cemetery, but the remains of only 85 individuals (many represented by incomplete skeletons) were present in the historical society collection. However, previously compiled age and sex information is used to supplement that collected for the NAGPRA inventory. A total of 44 adults of identifiable age (22 males, 22 females) and 35 subadults are included in the demographic analysis.

Indications of both continuity and change in mortuary practices suggest an attempt to both retain traditional ways and adapt to a new cultural context. Based on the presence of high rates of infection and nutritional deficiency within the sample, it is apparent that the Onondaga suffered from chronic health stresses similar to that experienced by other native groups during this period. Health stress within this group is interpreted as relating to living conditions within and surrounding this sedentary population, and stress associated with frequent warfare and population contact and intrusion. The Onondaga struggled to accommodate changing cultural and environmental circumstances; however, individuals frequently suffered the effects of cultural and environmental stress in the form of chronic health stress and premature death.

Can natural selection act on variations in group-adaptations such as language use?

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Group-selection differentiates variation in group-adaptations that promote the survival of the group as a whole, group-level sorting tends to preserve genotypic variation within and between groups. Because group-adaptations are the product of environmental and social channeling of the development of each member's potential, the systematic elimination of unsuccessfully adapted groups is unlikely to change the frequencies of alleles in the group or in the population as a whole. If language is an emergent property of groups, in which the activity of the linguistic community channels the development of its members, then language evolution cannot be a function of natural selection for large brains capable of language or for genetically encoded features of universal grammatical or semantic principles.

Language appears to be a self-organizing system that emerges as a function of encephalization, of the reorganization of an enlarged neocortex, and of prolonged immaturity, where development is channeled not only by design but also, more importantly, by the constraints of group-level adaptations. Unlike vision, no language develops when individuals, such as those deaf from birth, are for some reason isolated from a linguistic community. Although human beings must have a capacity for language, this capacity is not necessarily specific only to language processing.

Variation at the human melanocortin 1 receptor locus:  
Possible role in human pigmentation variation.

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Though human pigmentation is a highly visible trait and is the primary protection against the noxious effects of ultraviolet radiation, little is known about the genetic variation responsible for maintaining the large array of pigmentation observed in human populations. Variation in skin and hair pigmentation is due to varied amounts of eumelanin (brown/black melanins) and pheomelanin (red/yellow melanins) produced by the melanocytes. The melanocortin 1 receptor (MC1R) is a known regulator of eu- and pheomelanin production in non-primate mammals; single point mutations at the MC1R locus are responsible for coat color changes in mouse, fox, guinea pig, and cow. Previous studies on human populations have shown that MC1R variation exists in individuals with red hair and fair skin. In this study we have sequenced the MC1R locus in 121 individuals from different world populations with an emphasis on Asian populations: African, American Indian, Chinese, European descent, Indian, Japanese, Mongolian, Russian, Southeast Asian, and Yakut. We found variation at five nucleotide sites causing amino acid changes Arg67Gln, Asp84Glu, Val92Met, Arg151Cys, and Arg163Gln. In contrast, only one nucleotide site was found to vary without causing an amino acid change. Interestingly, the human consensus protein sequence is observed in all 25 African individuals studied but at lower frequencies in the other populations examined, especially in East and Southeast Asians. The Arg163Gln variant is absent in the Africans studied, almost absent in the Europeans, and at a low frequency (7%) in Indians, but is at an exceptionally high frequency (70%) in East and Southeast Asians. The MC1R genes in common chimpanzee, pygmy chimpanzee, gorilla, orangutan, and baboon were sequenced to study the evolution of MC1R and revealed that the ancestral human MC1R sequence is identical to the human consensus protein sequence. Functional assays indicate that a subset of these variants behave differently both from the human consensus MC1R and each other, supporting their role in pigmentation variation. Finally, nucleotide diversity at the MC1R locus is shown to be several times higher than the average nucleotide diversity in human populations, possibly due to diversifying selection.

Daily energy expenditure among lactating urban  
Bangladeshi women

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Daily energy expenditure has been shown to  
increase across the course of lactation among  
women in rural populations of the developing  
world. Understanding the extent to which this  
generalizes across rural and urban populations is  
important in defining the energy requirements of

such women. In this study, energy expenditure by  
heart rate monitoring, oxygen consumption and  
activity diary was carried out in 68 mothers from a  
poor urban area of Dhaka, Bangladesh, at 0, 1, 4  
and 8 months of lactation. The majority of  
mothers were below the poverty line, living in tin  
or thatched roof accommodation. Mean weight  
and BMI were 48.0kg and 20.3, respectively, at  
the start of lactation. Total daily energy  
expenditure increased slightly across the period  
of lactation, but not significantly so. However,  
energy expenditure expressed either per kilogram  
body weight, per kilogram fat-free mass showed  
significant increase across lactation (all  
 $p < 0.01$ ). The most substantial increase in energy  
expenditure per unit body size came after the first  
month of lactation, was due to the combination of  
slight decline in body weight and slight increase in  
total daily energy expenditure at this time. The  
mean level of physical activity, as defined in  
FAO/WHO/UNU (1985) is moderate to heavy in  
early lactation, becoming heavy in later lactation.  
The values for energy expenditure in the present  
study are comparable to among the highest  
values reported for women in developing  
countries.

Euprimate origins and postorbital bar function: the  
carnivoran and pteropodid evidence. M.J. RAVOSA<sup>1,2</sup>,  
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Versus the primitive condition of a postorbital  
ligament in archaic plesiadapiforms, modern primates  
show the derived presence of an ossified postorbital bar.  
Cartmill (1970, 1972, 1974, 1992) suggests that a shift to  
nocturnal visual predation in the earliest euprimates  
necessitated the orbital apertures to be directed more  
anteriorly and out of the plane of the temporal fossa.  
He further argues that this greater orbital convergence  
required the evolution of a postorbital bar to resist  
deformation of the lateral orbital margins during biting  
and chewing, thus ensuring a high level of visual acuity.  
Although more vertical orbital apertures also deviate  
from the plane of the temporal fossa, such increased  
orbital frontation is not thought to be functionally  
important in the formation of a bony postorbital bar.

In a series of allometric and non-allometric  
analyses (correlation, regression, ANCOVA, ANOVA),  
we test the structural and functional models regarding  
orbital orientation and postorbital bar development in  
living analogs which rely on visual foraging and vary  
interspecifically in postorbital bar formation - 28 felid  
(186), 28 herpestid (183) and 66 pteropodid (277) taxa.

Contrary to predictions, few of the structural factors  
posited to underlie variation in orbital convergence and  
frontation affect these angles. In the highly convergent  
and encephalized felids, orbital frontation is positively  
correlated with relative brain size. Felids with bony  
postorbital bars exhibit only higher orbital frontation  
values. As smaller-bodied taxa within a clade possess  
relatively larger brains, this explains why postorbital  
bars tend to characterize only smaller felids. Herpestids  
and pteropodids with bars are both more convergent

and larger in size; such a pattern is due to structural and/or behavioral factors. Importantly, as both orbital angles often covary positively, selection for variation in one requires or at least results in changes in the other.

The evolution of the postorbital bar in small-bodied mammals is variably linked to greater encephalization and a greater emphasis on stereoscopic visual foraging, both of which increasingly position the orbital aperture out of the plane of the temporal fossa. A consideration of Paleocene and Eocene primates indicates that the felid pattern of body-size, neural, cranial and behavioral transformations marks the origin of the first euprimates.

Supported by the NSF and the Leakey Foundation.

Brains and Behavior in *Hyllobates*. J. C. REDMOND Jr., State University of New York at Albany, Albany, NY 12222.

During mammalian evolution the increasingly differentiating and expanding brain allowed for the development of higher cognitive capacities concomitant with an enlarging repertoire of complex behavior. In primate evolution the increasing differentiation was not always symmetrical in the two hemispheres of the brain. Rather, larger brains seem to have been assembled with increased neuroanatomical asymmetries, some of which are known to reflect specific lateralized behaviors such as hand preference.

A large number of studies have looked separately at either cerebral asymmetries or handedness patterns in a variety of nonhuman primates, yet few have simultaneously examined cerebral and behavioral asymmetries within the same species. Moreover, sex differences and their association with brain and behavior asymmetries are often ignored. This report examines both the relationships between cerebral asymmetries and behavior and the interactive effect of sex on that relationship. To examine cerebral asymmetries, a 3D digitizer was used to model *H. syndactylus* male and female endocasts to determine right and left frontal, occipital and hemispheric volumes. Behavioral lateralizations were examined through video taped frame by frame analysis of leading limb preferences of male and female duetting and non-duetting *H. syndactylus* (n=24). Finally, sex differences in the relationship of brain size to body size were compared between male and female *H. lar* (n=68) to determine the relationship of sex on brains and subsequent behavior in a monogamous species of primate. Parametric and nonparametric tests, both within and across subjects, are used to interpret results at the individual, sex and population levels.

Effects of populations density on primate community structure. K.E. REED, Institute of Human Origins and Department of Anthropology, Arizona State University, Tempe, AZ 85287.

Previous studies comparing primate communities have found major intercontinental differences, but within

regions, communities are quite similar. Most of these studies use primate species characteristics to make these distinctions.

Primates species, for the most part, live in groups. The density of primates, as well species diversity, presumably affects the size and shape of ecological space that each community holds. This study examines how primate population density affects patterns of species diversity in primate communities and how size and shape of multivariate-defined community ecological space changes when population density is included in the analysis. The unit of analysis is the population of each primate, rather than the species.

Primate community composition, population densities, and species body mass were collected for 15 primate communities in forested regions of Africa, Asia, the Neotropics, and Madagascar. First, species diversity indices, designed to depict a community with a single number, were calculated. While species richness is often considered the number of species, diversity indices also include primate species abundances. Second, ecological characteristics, adjusted to reflect primate population densities, from eight communities were compared using principle coordinates analysis (PCO) to summarize nine dimensional ecological niche space.

Results show that diversity indices of Malagasy communities are highest; African and Asian communities are intermediate. South American communities have some of the lowest diversity values, although the Neotropics often have communities with the highest richness based on species number. The PCO shows that the ecological space encompassed by primate groups differs from ecological space held by primate species. For example, density serves to enlarge frugivorous ecological space taken by folivorous primates more than space occupied by frugivores. Primate community ecology is dependent not only on adaptations of primate species, but on the densities of these primate species as well.

Fossil tooth enamel composition. H.A. REESER, M.J. SCHOENINGER, J. VALLEY, and J. Fournelle, University of Wisconsin, Madison WI 53706.

The compositions of animal teeth from archaeological and paleontological sites contain climatic, ecological, and dietary information, but this can be scrambled by diagenetic processes. As yet there has been no rapid, site specific method for screening such materials. External appearance is not predictive of internal alteration and with few exceptions, fossil teeth retain an apatite pattern when assessed by XRD, IR, or FTIR. Minor alterations show no correlation with elemental or carbon and oxygen stable isotope ratios.

Cathodoluminescence (CL) microscopy identifies substitutions for calcium (Ca) and, thus, will show the diagenetic growth history of crystals. It has been used to guide stable isotope and microprobe sampling in geological carbonates and apatites although not previously applied to biological apatites. Teeth from seven modern, one Holocene, and 22 middle Pliocene

herbivores from the same region of northern Kenya were thin sectioned, scanned by CL, and analyzed using an electron microprobe. Modern and Holocene teeth exhibit bluish intrinsic luminescence and undetectable iron (Fe), Manganese (Mn) or fluorine (F) with the exception of one modern zebra of weathering stage 5. Pliocene teeth cluster into three color groups. 1) purple-, blue- or gray-black with clearly defined luminescent fronts at outer enamel margins containing up to 4 wt% F but no detectable Fe, Mn or diagenetic carbonate. 2) Green and yellow with poorly defined luminescent fronts, up to 3 wt% F, 4 wt% Fe, and .6 wt% Mn throughout but no diagenetic carbonate. 3) brown with detectable F, Fe, and Mn restricted to luminescent secondary inclusions. Apparently, three independent alteration events occurred within the site. Concentrations of P and Ca were normal in all samples.

Funded by: Wisconsin Alumni Research Foundation and NSF# SBR-9601532 (MJS&JV).

Analysis of commingled skeletal remains from a pre-contact cave site in the Jackson's Bay Cave series, Jamaica. E.A. REGA, J. MICHAELSON and L. TENYCK. W.M. Keck Science Center, The Claremont Colleges, Claremont, CA 91711

The commingled and fragmentary human skeletal remains recovered from the pit entrance of Sommersville Cave on the Portland Ridge afford a unique opportunity to examine a substantial sample of skeletons of the aboriginal inhabitants of Jamaica. Wet tropical climates are notorious for very poor preservation of bone. Thus, the remains from this dry cave, where accelerator dating of faunal material has produced a date of 710 +/- 60 years BP provide a rare opportunity to examine these prehistoric people.

Preliminary excavation was conducted in 1997 and 1998 in cooperation with the Jamaica National Heritage Trust to assess and collect human bones and artifacts which were present both as a surface scatter and deeper within the dry loose cave substrate. Results of the MNI analysis (minimum number of individuals) demonstrate that at least twelve individuals are represented in the skeletal sample. Taphonomic analysis of bone fragment size in conjunction with vertical location reveal a clear sorting of bone fragments by size - large fragments were nearer the surface, with small bones and bone fragments migrating to deeper levels. Circumstances of original deposition remain, however, unclear. Hypotheses include mass suicide, primary inhumation/exposure and subsequent disturbance or secondary placement of previously defleshed bones. Stable isotope analysis reveals a diet consisting of mixed terrestrial and marine resources. Pathology includes two examples of unhealed spiral fractures in separate individuals most likely resulting from falls of a great distance.

Experimental and comparative evidence shows direct cranial-hyolaryngeal relationships in the vertical and horizontal axes: Implications for reconstruction in fossil hominids. J.S. REIDENBERG and J.T. LAITMAN, Depts. of Cell Biology/Anatomy and Otolaryngology, Mount Sinai School of Medicine, New York, NY 10029.

Reconstructions of an ancestral hominid's aerodigestive tract have gained increasing importance for interpreting their breathing, swallowing, olfactory, or vocalizing abilities. While various approaches have been taken, few have been based on basic biological relationships between skeletal and soft tissues. For example, controlled experimental approaches are currently under-utilized. Similarly, while the comparative approach is sometimes used, it seldom extends beyond primates. In this study, we report on our ongoing research into the biomechanical relationship between cranial shape and hyolaryngeal position in different axes via two approaches: experimental and comparative.

Our experimental method explores cranial-hyolaryngeal relationships in the vertical axis (i.e., superior to inferior), using data derived from a longitudinal study of surgically altered rats (*Rattus norvegicus*). Results show that rats with artificially induced basicranial kyphosis (posterior skull base reoriented more vertically) have significant lowering of hyolaryngeal position compared to normal and sham operated controls. There is a strong correlation between hyolaryngeal positions and exocranial basicranial contour, thus demonstrating a direct biomechanical relationship.

Our comparative approach explores cranial-hyolaryngeal relationships in the horizontal axis (i.e., left to right). The sample consists of specimens from 25 terrestrial and 24 aquatic genera, including toothed whales which, by virtue of their respiratory tract adaptations to an environmental extreme, serve as an ideal "natural experiment" to test relationships. Results show that while most terrestrial species are symmetrical in skull morphology and hyolaryngeal position, toothed whales are not. This group exhibits left-right cranial asymmetry paralleled by left-right asymmetry in hyolaryngeal position. Interestingly, no asymmetry is found in the mandible. Further, as the hyoid apparatus and larynx are not asymmetrical in morphology, only their position appears biomechanically related to cranial morphology.

Both the experimental and comparative studies indicate that changes in cranial shape in an axis affect hyolaryngeal position in that same axis. These relationships are of considerable importance when reconstructing the anatomy of the aerodigestive tract in fossil hominids.

Supported by Office of Naval Research #N00014-96-1-0764, and Am. Mus. Nat. Hist. Speech Origins Fund.

Anthropometric data, population genetics, and population history. J.H. RELETHFORD, State University of New York College at Oneonta, Oneonta, NY 13820

Biological anthropologists rely on a wide variety of data to reconstruct past population history. While there has been much emphasis recently on DNA markers for reconstructing population history, many of the newest markers are still limited by sample size and geographic range. While we welcome new data and new methods, we should not automatically dismiss older sources of data, such as anthropometrics, which have often been collected on a huge number of subjects. Such data were often collected and analyzed in the context of racial analysis and in the



absence of sophisticated genetic models and quantitative analyses. Recent developments in population quantitative genetics allow more detailed microevolutionary analyses of population history.

Two examples of the utility of anthropometric data in the study of population history are presented here, both based on data from earlier studies of Ireland. The first study is based on data from an anthropometric survey conducted in the 1890s of several small islands and coastal communities from the west coast of Ireland. Analysis of 10 anthropometric measures shows that the primary determinant of among-group variation relates directly to population history, specifically English admixture resulting from the garrisoning of soldiers on several strategic islands starting in the late 1500s. Secondary factors include geographic isolation and genetic drift. The second study is based on data from an anthropometric survey of the entire island of Ireland undertaken by Harvard University in the 1930s, resulting in the collection of anthropometric data on almost 9,000 adult men and 2,000 adult women. Analysis of 17 anthropometric measures shows that the population history of the entire island is not described well by traditional isolation by distance models. Instead, the patterns of among-group variation show the impact of two key historical events—Viking invasion during the 8<sup>th</sup> and 9<sup>th</sup> centuries, and English and Welsh immigration beginning in the 17<sup>th</sup> century.

Supported in part by NSF Grant No. DBS-9120185

**Nutritional Aspects of Diet of Gorillas at Bai Hokou, Central African Republic with inter-population and interspecific comparisons.** REMIS, M.J. Sociology and Anthropology, Purdue University, West Lafayette, IN 47907.

Fruits partially consumed by gorillas (*Gorilla gorilla gorilla*), chimpanzees (*Pan troglodytes troglodytes*) and mangabeys (*Lophocebus albigena*) during observations and along gorilla feeding trails, June-July, 1998 at Bai Hokou, Central African Republic were collected and analyzed for nutrient and tannin content (n=50). Food availability was measured along established phenology trails (>600 trees). Results are compared to results from previous studies of gorilla nutrition including Rogers et al. (1990) and Carroll (unpub).

Because of their large body size, gorillas are expected to consume more fibrous and tannin-rich foods than chimpanzees or mangabeys. Nevertheless based on previous work, gorillas and chimpanzees are also expected to consume a high proportion of ripe, fleshy fruits during this wet-season period. However, during this El Niño year, ripe fruit was relatively scarce. Both apes consumed fibrous and unripe fruit. These

fallback foods are more typical of gorillas, but not chimpanzees, during seasonal periods of fruit scarcity than during the fruiting season. Despite seasonal fleshy fruit in their diets, western lowland gorillas across sites may consume more tannin rich foods than mountain gorillas. Differences between gorilla subspecies and populations help us to understand the roles of habitat and food availability in shaping gorilla diet and niche overlap among African apes.

**Estimation of Sexual Dimorphism in Fossil Species including *Australopithecus afarensis*: A New Technique and Tests of its Accuracy Using Extant Hominoids.** P.L. RENO<sup>1</sup>, C.O. LOVEJOY<sup>1</sup>, K.F. KERN<sup>2</sup>, S.W. SIMPSON<sup>3</sup>, and R.S. MEINDL<sup>1</sup>. <sup>1</sup>Department of Biomedical Sciences, Kent State University, Kent, OH 44242; <sup>2</sup>Department of History, Bowling Green State University, Bowling Green, OH 43403; <sup>3</sup>Department of Anatomy, Case Western Reserve University, Cleveland, OH 44106.

Body size dimorphism is an important parameter of social structure and reproductive strategy in primates. A number of previous studies have suggested that *A. afarensis* was characterized by dimorphism most similar to *Gorilla*. Many of these used either extreme values for small samples of metrics from a single skeletal site, or relied on estimates of body mass or stature to compute dimorphism. Such procedures introduce unnecessary intermediate estimation errors. Our method of technique dimorphism (TDM) aids in eliminating such errors (Lovejoy et al., 1989, In G. Giacobini, Ed. *Hominidae*. Milan: Jaka Book, pp. 103-108).

Afar Locality 333 provides a fossil assemblage which is limited geographically and temporally. It should provide an accurate estimate of dimorphism in *A. afarensis*. Using skeletal ratios obtained from AL 288-1, humeral biepicondylar breadth, which is shown to be a good predictor of skeletal size, was estimated for each individual represented by a postcranial element for both a large Hadar sample and one restricted to specimens from Locality 333. Simulations using extant taxa were then conducted to test the probable accuracy of the above procedures. Simulated samples (n = 30) whose anatomical site composition was identical to the two from Hadar were randomly constructed. An individual template specimen (to represent AL-288) was also randomly chosen in each case. Each simulation thus exactly reproduces the procedures applied to the two Hadar samples. 500 such simulations were conducted for *H. sapiens*, *P. troglodytes* and *G. gorilla*. Actual skeletal dimorphism and TDM were calculated for each trial. Means of the simulations for each species are as follows: *Pan* true mean = 1.03, TDM = 1.15; *Homo* true mean = 1.15, TDM = 1.18; and *Gorilla* true mean = 1.34, TDM = 1.27. TDM values are 1.20 for the entire 1973-1977 Hadar sample (n = 28) and 1.16 for AL 333 (n = 22). These results suggest that *A. afarensis* was characterized by moderate dimorphism most similar to modern humans.

An American Indian and health sciences perspective on the peopling of the Americas. E Rhoades, University of Oklahoma, Oklahoma City, OK 73190

The study of genetic markers in American Indian populations is not a new phenomenon and data have been accumulating in various ways for decades. However, the interest in American Indian genetic diversity has been intensified by the exquisite precision of modern molecular analysis and its potential for illuminating diverse phenomena including the hereditary underpinnings of health and disease, forensic identification, and the history of human migrations. Despite these exciting prospects, genetic studies are often met with trepidation by American Indians. This paper will review several concerns circulating in the American Indian community in the hope of facilitating a better understanding among researchers and their potential subjects.

First, many American Indian people are concerned that genetics research has unknown consequences, some of which are potentially adverse. For example, unwarranted and unwanted genetic characterizations of American Indians may be uncritically accepted by non-Indians. Second, genetic evidence on human migrations potentially conflicts with traditional American Indian beliefs regarding population origins. Some Indians fear that this information will further erode traditional ways that are already jeopardized by Euro-Americans, and they fear that migration theories based on genetic diversity will be used to undermine American Indian claims to their lands. Third, there is a feeling that genetics (and other) research is not being conducted so that the communities being studied are the beneficiaries.

The remedies for these concerns are not simple. However, they will arise by increasing direct communication between researchers and their subjects. They will also arise by encouraging research that results in practical benefits related to the health, education, and well being of the participants and the communities that they belong to.

Knuckle-walking traits retained in the wrist of early hominids. B.G. RICHMOND and D.S. STRAIT, Dept. Anthropology, George Washington University, Washington, D.C., 20052.

The question of whether hominids arose from arboreal or terrestrial ancestors is critical to theories about the origins of bipedalism. Here, we present evidence that early hominids evolved from knuckle-walking ancestors.

The distally projecting dorsal ridge of the radius is widely accepted as a mechanism to resist wrist extension during knuckle-walking in African apes. Closer inspection reveals that the dorsal ridge possesses a notch that accommodates a concavity on the dorsal margin of the proximal articular surface of the scaphoid. This locking mechanism limits extension (and slight abduction), and provides wrist stability in late stance phase of knuckle-walking. A strong dorsal ridge of the radius is absent in

baboons, macaques, gibbons, and humans, but present in chimpanzees, gorillas, and some orangutans. However, in those orangutans that exhibit a dorsal ridge, the scaphoid notch is smaller, faces more laterally and does not extend medially across the dorsal margin of the radius as it does in African apes. In other words, the dorsal ridge in *Pongo* is not designed to limit wrist extension – an observation corroborated by data on the range of wrist extension in living orangutans.

Fossil radii attributed to *Praeanthropus africanus* (*Australopithecus afarensis*; AL288-1q/v) possess a well-developed dorsal ridge with a medially-extended scaphoid notch. Given the derived bipedal morphology of the hominid hindlimb and the absence of weight-bearing features of metacarpophalangeal joint, it is not likely that early hominids continued to practice knuckle-walking. Rather, the persistence of the dorsal ridge suggests that protohominids evolved from a knuckle-walker. The retention of arboreal traits elsewhere in the early hominid skeleton suggests that climbing also may have been important in protohominid locomotion, much as it is in African apes. Knuckle-walking appears to be a derived feature of the African ape and human clade. This raises the question of why bipedalism would have evolved in an ancestor that was already partially terrestrial.

Supported by The Henry Luce Foundation.

Morphological characteristics and developmental processes of aneuploidy. J.T. RICHTSMEIER, L.L. BAXTER, and R.H. REEVES, The Johns Hopkins School of Medicine, Baltimore, MD 21205.

Trisomy 21, or Down Syndrome (DS), produces a number of distinctive morphological characteristics of postcranial and cranial structures in humans. Ts65Dn mice, a murine model for DS, have segmental trisomy for most of the portion of Chr16 that is homologous to human chromosome 21. To determine how closely phenotypic anomalies in DS are reflected in this animal model, craniofacial morphology was assessed on skulls of Ts65Dn mice (N=7) and their normal littermates (N=13). Euclidean Distance Matrix Analysis demonstrated that the face of Ts65Dn mice is significantly less prognathic than control littermates, that the neurocranium is brachycephalic and that mandibular abnormalities are apparent. DS individuals demonstrate similar patterns of abnormalities in the upper face, neurocranium and mandible. Quantitative studies report increased variability for linear dimensions in DS individuals as compared to normal. Ts65Dn mice exhibited increased phenotypic variance in craniofacial skeletal features. These findings suggest a similar developmental perturbation caused by dosage imbalance of corresponding genes in Ts65Dn and in DS individuals.

An evolutionary developmental approach to the study of aneuploidy anticipates profound phenotypic effects and predicts increased variance for metric traits caused by developmental instability of a once-diploid organism. Canalization is the capacity of the organism to respond to internal or external variables so as to reduce phenotypic variability, and produce an optimum or average phenotype. Rice (1998) has emphasized that epistasis, the phenotypic

effect of interaction among alleles at multiple loci, is fundamental to the evolution of canalization. Aneuploidy presents the developing organism with information that does not "fit" within the processes that produced canalization. The phenotypic aspects of aneuploidy are obvious, but the developmental aspects are not well studied, and remain obscure. Our findings suggest the Ts65Dn mouse as an excellent tool for studying the developmental aspects of aneuploidy.

Supported in part by a National Research Service Award to JTR (F33 DE 05706 01) and NIH 2P01-HD24605-10.

Evolution of neocortical size and gyrification in hominids: evidence from comparative neuroanatomy. J.K. RILLING and T.R. INSEL, Department of Anthropology and Yerkes Primate Center, Emory University, Atlanta, GA 30322

Neuroanatomic data from 11 species of extant anthropoid primates were used to investigate whether the internal organization of the human brain was uniquely modified during hominid evolution. Specifically, we ask if the size of the human neocortex and its regional pattern of gyrification are predictable based on primate allometric trends. Whole brain MRI (1.5 T, T1-weighted) scans were collected from 44 living anthropoid primates, including all of the great ape species. Image analysis software was used to measure the volume of the entire brain, the neocortex and the cerebral white matter in each scan. Following Zilles et. al. (1988), a gyrification index was calculated for each of 10 coronal slices in each brain.

Regression of neocortical volume on total brain volume reveals that the human neocortex is not larger than expected for an anthropoid of our brain size. However, when neocortical volume is regressed on the volume of the rest of the brain to eliminate the part-whole fallacy (Deacon, 1988), the human neocortex is significantly larger than predicted by non-human anthropoid allometry.

Regression of whole brain gyrification indices on brain volume reveals that the human brain is not significantly more convoluted than expected for our brain size. Nevertheless, certain regions of the human brain are significantly more gyrified than predicted by allometric trends for non-human anthropoids.

These results are consistent with our earlier report on cerebellar size (1998) in suggesting that hominid brain evolution involved not only dramatic expansion but also reorganization in which natural selection displaced humans from non-human primate allometric trajectories governing brain growth. Supported by a grant from the L.S.B. Leakey Foundation and by Yerkes Primate Center grant from NIH-NCRR.

Histomorphometric and gross geometric correlates in the femoral midshaft: relation to the local mechanical loading environment. A.G. ROBLING, Department of Anthropology, University of Missouri, Columbia, MO 65211.

The relation between mechanical loading and bone biodynamics on the periosteal and endosteal envelopes of long-bone diaphyses has been used extensively as the basis for hypothesizing differences in activity levels among and within skeletal populations. The Haversian envelope, though also responsive to loads, has received little attention in biomechanical analyses of skeletal remains despite the fact that this envelope is frequently well-preserved. A major obstacle in mechanical interpretations of cortical microstructure stems from difficulties in differentiating the relative contribution of systemic (e.g., circulating hormones) influences and local (mechanical) influences to an observed histomorphology.

I present and evaluate a technique that controls for some of the systemic influence on intracortical turnover in the midshaft femur, so that a biomechanical interpretation of the Haversian envelope is possible. The technique is tested against the mechanical loading history derived from the periosteal and endosteal envelopes (gross geometry).

Histologic sections were prepared from both the midshaft femur and the middle  $\frac{1}{3}$  of the 6th rib in 49 adults (26♂, 23♀) excavated from a Preceramic Peruvian site. Histomorphometric data were collected from both elements. By virtue of its more homogeneous biomechanical role among individuals, the rib turnover was used as an index of individual global turnover. Femoral osteon population density (OPD<sub>F</sub>) was regressed onto rib OPD (OPD<sub>R</sub>), from which residual scores (<sup>R</sup>) were calculated (<sup>R</sup>OPD<sub>F</sub>). According to the model, <sup>R</sup>OPD<sub>F</sub> represents local femoral turnover not accounted for by systemic influences.

Second moments of area (*I*<sub>max</sub>, *I*<sub>min</sub>, *J*) were calculated from the same femur sections used in the histological analysis. Bending and torsional moments were standardized for body mass and beam length by calculating residual scores from the regression of second moments onto [body mass × femur length].

Residual scores from the gross geometric analysis (<sup>R</sup>*I*<sub>max</sub>, <sup>R</sup>*I*<sub>min</sub>, <sup>R</sup>*J*) were plotted against residual scores from the histologic analysis in the femur (<sup>R</sup>OPD<sub>F</sub>). Significant, positive correlations were found between <sup>R</sup>OPD<sub>F</sub> and <sup>R</sup>*I*<sub>max</sub> and between <sup>R</sup>OPD<sub>F</sub> and <sup>R</sup>*J*, but not between <sup>R</sup>OPD<sub>F</sub> and <sup>R</sup>*I*<sub>min</sub>. The results indicate that local intracortical remodeling in the midshaft femur, after correction for systemic influences, is greater in cross sections exhibiting greater bending and torsional rigidity and is lower in sections exhibiting lower rigidity. These data confirm clinical and experimental studies addressing the influence of mechanical usage on local Haversian turnover, and suggest that a significant amount of nonmechanically induced turnover in the femoral cortex can be accounted for by standardization with the rib.

Sickle cell haplotypes of the African American "Gullah" of the South Carolina Sea Islands. N.L. Rogers<sup>1</sup>, G. Argyropoulos<sup>2</sup>, W.T. Garvey<sup>2</sup>. <sup>1</sup>Department of Anthropology, University of Tennessee, Knoxville, 37996, <sup>2</sup>Division of Endocrinology, Medical University of South Carolina, Charleston 29525

Four independent β-chain mutations resulting in sickle cell have been documented in Africa, each with a discrete geographic distribution along the West African coast. By identifying the mutation responsible for a patient's sickle cell disease, the origin of at least two of

the individual's ancestors can be determined. This method can be used to test the accuracy of historical data and to explore the genetic diversity and dynamics of African American populations.

A large number of the African Americans native to the South Carolina Sea Islands are expected to express the Central African Republic (Bantu) or Senegal haplotype since they are descended from the enslaved Africans imported to the area. A majority of these Africans originated in Angola, Congo and the Windward coast (Sierra Leone, Senegal, and Gambia).

To test these expectations, haplotypes were determined for individuals homozygous for the sickle cell allele using five polymorphic sites. The polymerase chain reaction (PCR) was employed to amplify genomic DNA from participating individuals and amplicons were subsequently digested by the five corresponding restriction endonucleases. Each individual was classified as an area native or migrant based upon their grandparents' birthplace. Those for whom birthplace data were not available were classified as migrant.

The Benin haplotype was the most common in the native group (63%), followed by the Central African Republic (20%) and the Senegal haplotype (17%). This pattern was also present in the migrant group, with 51% expression of the Benin type, 29% Central African Republic, and 20% Senegal type. These results are contra the predictions of the historical record and impel further study of West African populations to determine the genetic affinity of the Sea Island population.

Supported by NIH grant #DK47461 and by an endowment by the Pollitzers of Chapel Hill, NC.

Environmental and linguistic evidence relevant to New World colonization.  
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Languages and gene pools are information storage systems. Both have been shaped by historic factors and thus present clues to their past. Diversification into multiple taxonomic groups requires isolation for either gene pools or languages. Geographic barriers are likely to be the chief cause of isolation, and these barriers have changed radically since the late Wisconsin. These ice age barriers have left a distinct imprint on the diversity of languages in the New World and suggest a coastal entrance, the potential influence of glacial barriers, and radiations into distinct biogeographic zones that no longer exist.

Ancient ice age barriers offer a more parsimonious explanation of native New World diversity than multiple hypothetical migrations from the Old World by varied groups.

Population genetic studies of Athabascan speaking populations in the American Southwest. F.C. Romero<sup>1,2</sup>, M. Urbanek<sup>1,3</sup>, D. Goldman<sup>1</sup>, J.C. Long<sup>1</sup>. <sup>1</sup>Laboratory of Neurogenetics, NIH/NIAAA, Bethesda, MD 20892, <sup>2</sup>Department of Anthropology, University of New Mexico, Albuquerque, NM 87131, and <sup>3</sup>University of Pennsylvania, Philadelphia, PA 19104.

The migration into North America separated the Athabascans into sub-arctic, pacific and southwestern geographic regions. This separation over time and space in diverse environments has resulted in distinct population identification. We present here the genetic variation of Southwestern American Athabascan-speaking populations.

This study tests whether a correspondence exists between linguistic, cultural, and historical classifications and genetic affinities. The Athabascan populations tested include two distant Apache bands, the Navajo, three Navajo isolates, and Alaskan Natives. In addition, control populations of Amerinds and Europeans were included in our analyses: Cheyenne, Keres 1, N Tiwa 2, and Swedes. Twenty-one highly polymorphic dinucleotide repeat loci, with 234 segregating alleles, spanning chromosomes 1, 6, 7, 9, 10, 11 and 20, were genotyped using PCR. The number of alleles and allele frequencies were assessed by direct gene counting. Tests for hierarchical structure were performed using the maximum likelihood test for treeness and the jackknife method to obtain improved estimates of tree parameters.

Heterozygosities and the number of alleles were high in Athabascans, but lower than published values for Europeans. Although loci differences exist between the tribes, the differences were not accounted for by our hierarchical classification and maximum likelihood tree. The neighbor joining tree program was used to generate a topology which fit the genetic data. The resulting tree confirmed the genetic distinction between the Swedes and the Native American populations and between the Alaskans and the Southern Native American populations. Although small, each branch leading to the Native Americans was necessary for the higher order of the tree.

This work was supported by NSF grant BNS-9108422 and the NIAAA intramural research program.

The Early-Middle Pleistocene Homo-bearing succession of Buia (Eritrea). L. ROOK, G. FICCARELLI, and D. TORRE, Earth Sciences Department and Paleontological Museum, University of Florence, Italy; R.J. CLARKE, Palaeoanthropological Research Group, University of the Witwatersrand, Johannesburg, South Africa; R. MACCHIARELLI, National Prehistoric Ethnographic "L. Pigorini" Museum, Rome, Italy; B. TESFMARIAM and J. LIEBESKAL, National Museum of Asmara, Eritrea.

Geopaleontological field research was carried out in 1995-1997 by an Italo-Eritrean team in the northern part of the Danakil (Afar) Depression of Eritrea. Several Pleistocene



vertebrate sites with widespread oldowan and acheulean artifacts were discovered along a 600 m thick fluvio-lacustrine outcropping succession in the area of the Buia village, 100 Km south of Massawa. To date, one locality (Uadi Aalad) yielded skeletal and dental remains attributable to fossil *Homo* (Abbate et al., 1998). Vertebrate biochronology, paleomagnetic analyses, and radiometric datings indicate an age interval from the beginning of the early Pleistocene to the early Middle Pleistocene for the entire *Homo*-bearing outcrop. In particular, the 1.4 m thick *Homo* layer of laminated silty clays has been paleomagnetically referred to the top of the Jaramillo subchron (ab. 1.0 Myr).

The human remains include two lower permanent incisors (UA 222 and UA 369) and an extraordinarily well preserved and undistorted adult cranium (UA 31) consisting of a large portion of a braincase and of eleven vault and facial fragments partially covered by a hard sandy matrix. The specimen, which falls within the 1.4-0.6 Myr time interval from which no human cranial remains of comparable integrity are currently reported from Africa, shows a mixture of *Homo erectus* and *sapiens*-like morphoarchitectural features. These latter include a rather high position of the greatest biparietal breadth associated with parietal walls converging slightly inferiorly in coronal section, a morphology not seen in specimens commonly referred to *H. erectus* s.l. The combination in UA 31 of primitive and derived features provides new perspectives to the interpretation of the origins and evolution of early *sapiens*-like cranial morphologies in Africa.

Body size, body proportions and encephalization in the Jinniushan specimen. K.R. ROSENBERG, Dept. of Anthropology, University of Delaware, Newark, DE, LÜ Z., Dept. of Archaeology, Peking University, Beijing, China and C.B. RUFF, Johns Hopkins University School of Medicine, Baltimore, MD

The Jinniushan specimen, from Liaoning Province in northeastern China was discovered in 1984 in an isolated karst prominence in a fissure in a collapsed limestone cave. ESR and uranium series dating of animal teeth from the hominid level yield a date of about 280,000 years ago, consistent with the associated fauna. The specimen represents a single individual preserving the cranium, six vertebrae, two ribs, an innominate, a patella, a complete ulna, and many bones of both hands and feet. Analysis and comparison of the cranial and pelvic morphology with relevant specimens indicate that the Jinniushan specimen is female.

The preservation of associated cranial and postcranial material provides a rare opportunity to estimate body size, pelvic shape, body shape and encephalization quotient for a single individual from this time period. We used the innominate to reconstruct both approximate pelvic inlet shape and bi-iliac breadth. Bi-iliac breadth is very large, about 344 mm. We calculated a stature of 168 cm from maximum ulnar length (260 mm), using appropriate modern human reference samples. Using formulas derived from recent humans, body mass can be calculated from stature and bi-iliac breadth as 79.5 kg. Femoral head diameter can be calculated from acetabular diameter to be about 50.2 mm. Body mass calculated from femoral head diameter

is 75.9 kg, giving a mean estimate for body mass of 77.7 kg. Jinniushan is therefore the largest known Pleistocene human female but is still smaller than estimates for many other Middle to early late Pleistocene specimens thought to be male. This supports previous observations of large body size in Pleistocene *Homo*, particularly at high latitudes.

The Jinniushan specimen also appears to be cold adapted in its body shape, with a wide body relative to ulna length and estimated stature, consistent with other high latitude specimens from this time period.

Jinniushan has a cranial capacity close to 1300 cc giving an encephalization quotient (using Martin's formula for mammals) of 4.093 which falls between previous estimates for middle and late Middle Pleistocene *Homo* of 3.818 and 4.257 respectively. This confirms EQ estimates for middle Pleistocene *Homo* based on sample means from unassociated specimens.

This research was supported, in part, by the Committee on Scholarly Communication with China.

A reconstruction of the Sts 14 pelvis, and the obstetrics of *Australopithecus*. B.A. ROSENMAN, C.O. LOVEJOY, L.B. SPURLOCK, Department of Anthropology and School of Biomedical Sciences, Kent State University, Kent OH 44242, and R.G. TAGUE, Department of Geography and Anthropology, Louisiana State University, Baton Rouge, LA 70803.

Two specimens, Sts 14 and AL 288-1, are central to our understanding of the pelvic anatomy and obstetrics of *Australopithecus*. Both fossils suffered considerable damage during fossilization, however. While AL 288-1 has been successfully restored (Lovejoy, 1979, *Am. J. Phys. Anthropol.* 50:460), Robinson's 1972 reconstruction of Sts 14 has incorporated several misinterpretations of postmortem damage. His reconstruction also appears to have incorporated bias from modern human morphology. Two recent attempts at an improved reconstruction (Abitbol, 1995, *Am. J. Phys. Anthropol.* 96:143-158 and Häusler and Schmid, 1995, *J. Hum. Evol.* 29:363-383) also fail to correct for these serious postmortem deformations. This study offers a new reconstruction of Sts 14 that includes correction of these distortions.

Our reconstruction of Sts 14 is more platypelloid than previous versions. Its pelvic inlet index (AP x 100/TRV) is 68; only AL 288-1, with an index of 58, is more platypelloid. Sts 14's index is significantly lower than those of all previous Sts 14 reconstructions, which closely approximate the modern female *Homo sapiens* mean. Sts 14 and AL 288-1 are very similar in size and shape, with both specimens exhibiting all the hallmarks of habitual bipedality. Both specimens have similar anteroposterior diameters, although the transverse diameters of Sts 14 are less than those of AL 288-1, a consequence of Sts 14's slightly smaller size. Analysis reveals that, even with its platypelloidy, our reconstruction of Sts 14 is more obstetrically adequate than several extant primate species, including *Homo sapiens*. Finally, further obstetrical analysis and comparison with AL 288-1 indicate that the *A. africanus* neonate most likely presented transversely through all pelvic planes, as has been hypothesized for *A. afarensis*.